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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Natsuo Tatsumi

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EXAMINER

BREVAL, ELMITO

ART UNIT

PAPER NUMBER

2889

MAIL DATE

DELIVERY MODE

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/554,188	TATSUMI ET AL.	
	Examiner	Art Unit	
	ELMITO BREVAL	2889	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 September 2009.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-22 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

The amendment filed on 09/03/2009 has been entered.

Claims 1-22 are pending.

Response to Arguments

Applicant's arguments with respect to claims 1-22 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 9, and 16-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Masahiro (JP: 4-245135) of record by the applicant in view of Osamu et al., (JP: 10-294077) of record by the applicant.

Regarding claim 1, Masahiro ('135) teaches (in at least figs. 1 and 5; abstract) an electron emitting device comprising a light device for irradiating light to a cathode (best seen in figs. 5a and 5b), wherein at least an electron emission face (107) of said cathode, the light emitting device comprises a junction (109) formed between the cathode (107) and another element of the electron emission device (110; see at least fig. 1; i.e. item 109 formed a junction between the cathode 107 and the anode electrode 110; Note: the examiner interprets the other element to be the anode 110).

However, Masahiro ('135) does not teach the cathode face is made of diamond.

Further regarding claim 1, Osamu ('077) teaches (in at least figs. 1-5; [0012]-[0015]; abstract) an electron emission device wherein at least an electron emission face is made of diamond, for the purpose of generating high electric field ([0004]).

Hence, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the diamond face of Osamu into the device of Masahiro, for the purpose of generating high electric field.

Regarding claim 9, Osamu ('077) discloses (in at least figs. 1-4) the electron emission face contains a sharpened projection part. The reason for combining is the same as for claim 1.

Regarding claim 16, Masahiro as modified by Osamu discloses the electron emission device is composed as one unit with said cathode (see fig. 1).

Regarding claim 17, Masahiro ('135) teaches (in at least figs. 1 and 5) an electron beam source electron emission device, wherein a light emitting device for irradiating a cathode and a cathode (107) are disposed together in an electron gun (best seen in fig. 5), wherein the light emitting device comprises a junction (109) formed between the cathode (107) and another element (110; i.e. the anode) of the electron emission device (see at least fig. 1; i.e. item 109 formed a junction between the cathode 107 and the anode electrode 110; Note: the examiner interprets the other element to be the anode 110).

However, Masahiro ('135) does not teach the cathode face is made of diamond.

Further regarding claim 17, Osamu ('077) teaches (in at least figs. 1-5; [0012]-[0015]; abstract) an electron emission device wherein at least an electron emission face is made of diamond, for the purpose of generating high electric field ([0004]).

Hence, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the diamond face of Osamu into the device of Masahiro, for the purpose of generating high electric field.

Regarding claim 18, Osamu discloses (in at least fig. 2) an anode is separated by a space from said cathode, in which at least an electron emission face is diamond; and a voltage that is positive relative to said cathode is applied to said anode. The reason for combining is the same as for claim 17.

Regarding claim 19, Osamu discloses (in at least fig. 2; [0010]-[0015]) a control electrode is disposed between said cathode and said anode to regulate an emission electron current and said cathode. The reason for combining is the same as for claim 17.

Claims 2-8, 10-15 and 20-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Masahiro (JP: 4-245135) of record by the applicant and Osamu et al., (JP: 10-294077) of record by the applicant as applied to claims 1,9, and 16-19 above, and further in view of Hirabayashi (US. Pat: 5,541,423) partially of record by the applicant.

Regarding claim 2, Masahiro-Osamu disclose the electron emission device of claim 1, but fail to disclose the light emitting device is made of diamond.

However, Hirabayashi ('423) teaches (in at least figs. 1-10; abstract) a device wherein the light emitting device is made of diamond, for the purpose of having a device that can operate with a large current and which exhibits superior pn junction characteristics, as well as high durability .

Hence, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the light emitting device made of diamond as taught by Hirabayashi into the device of Masahiro-Osamu, for the purpose of having a device that can operate with a large current and which exhibits superior pn junction characteristics, as well as high durability.

Regarding claim 3, Hirabayashi ('423) teaches (in at least fig. 3; col. 13-col. 14, lines 14), the cathode comprises an n-type diamond (98). The reason for combining is the same as for claim 2.

Regarding claim 4, Hirabayashi ('423) teaches (in at least fig. 3; col. 13-col. 14, line 14) the electron emission face of the cathode is a p-type diamond. The reason for combining is the same as for claim 2.

Regarding claim 5, Hirabayashi ('423) teaches the diamond semiconductor includes crystal defects (col. 7, lines 1-6). The reason for combining is the same as for claim 2.

Regarding claim 6, Hirabayashi ('432) teaches the electron emission face of the cathode is hydrogen terminated (col. 2, lines 22-34). The reason for combining is the same as for claim 2.

Regarding claim 7, Hirabayashi ('432) teaches the electron emission face of the cathode is oxygen terminated (col. 2, lines 22-34). The reason for combining is the same as for claim 2.

Regarding claim 8, Hirabayashi ('423) discloses (abstract; col. 2, lines 44-48; col. 5, lines 6-11) the light emitting device is composed of a pn junction of diamond, a schottky junction or a MIS structure. The reason for combining is the same as for claim 2.

Regarding claim 10, Hirabayashi ('423) discloses (col. 1, line 19) the wavelength energy of light emitted from said light emitting device includes 5.4 eV. The reason for combining is the same as for claim 2.

Regarding claim 11, Hirabayashi ('423) discloses (col. 1, line 19) the wavelength of light emitting device is greater than 2 eV. The reason for combining is the same as for claim 2.

Regarding claim 12, Hirabayashi ('423) discloses (in at least figs. 1-10; col. 4, lines 11-29) the light from said light emitting device excites electrons in an impurity level to a conduction band. The reason for combining is the same as for claim 2.

Regarding claim 13, Hirabayashi ('423) discloses (in at least figs. 1-10; col. 3, lines 54-60; col. 4, lines 11-29) the light emitting device excites electrons in a band gap level to a conduction band. The reason for combining is the same for claim 2.

Regarding claim 14, Hirabayashi ('423) discloses (in at least figs. 1-10; col. 4, lines 4-5; lines 57-68) the light from light emitting excites electrons in a level resulting from grain boundary defect. The reason for combining is the same as for claim 2.

Regarding claim 15, Hirabayashi ('423) teaches the n-type diamond contains lithium as an impurity (col. 2, lines 57-58). The reason for combining is the same as for claim 2.

Regarding claim 20, Hirabayashi ('423) teaches (in at least fig. 3; col. 13-col. 14, lines 14), the cathode comprises an n-type diamond (98) and a p-type diamond (97; i.e. the other element). The reason for combining is the same as for claim 2.

Regarding claim 21, Hirabayashi ('423) teaches (in at least fig. 3; col. 13-col. 14, lines 14), the cathode comprises an n-type diamond (98) and a p-type diamond (97; i.e. the other element). The reason for combining is the same as for claim 2.

Regarding claim 22, Hirabayashi ('423) teaches (in col. 7, lines 24-25) the cathode comprises schottky electrode (3; i.e. the other electrode) and a p-type diamond crystal layer (2). The reason for combining is the same as for claim 2.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

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extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ELMITO BREVAL whose telephone number is (571)270-3099. The examiner can normally be reached on M-F (8:30 AM-5:00 Pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Toan Ton can be reached on (571)-272-2303. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

December 16, 2009
/Elmito Breval/
Examiner, Art Unit 2889

/Bumsuk Won/
Primary Examiner, Art Unit 2889